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ABSTRACT

Summarizing the highlights of four monographs on the recruitment and retention of black Americans in engineering at Purdue University, the report details 1966-76 statistical trends. The overall results of the study indicate that the number and proportion of black students beginning engineering at Purdue and nationally has increased significantly in recent years, but is still relatively small. The best predictor of retention of black students in engineering is college grades. College board scores are relatively poor predictors of grades or retention. Freshman expectations of college, Purdue, and engineering were similar for black and non-black students but external factors including financial aid were apt to be more important for black students. Black students transferred and withdrew largely due to grades and interest. Purdue black B.S. engineering graduates surveyed in 1974 had and were continuing to pursue advanced graduate and professional degrees, and held positions of responsibility in both technical and managerial fields. They achieved higher than average salaries and generally were quite satisfied with their jobs, careers, and choice of engineering and Purdue. (Author/PHR)

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FACTORS ASSOCIATED WITH ATTRACTING AND RETAINING BLACK AMERICANS IN ENGINEERING

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Abstract

As part of a comprehensive study of recruitment and retention of Black Americans in engineering at Purdue, four monographs were prepared on 1966-76 statistical trends; freshman expectations of college, Purdue, and engineering; black engineering persisters, transfers and withdrawals; and a follow-up study of Purdue black engineering graduates.

The overall results of the study indicate that the number and proportion of black students beginning engineering at Purdue and nationally has increased significantly in recent years, but the number of graduates is still relatively small. The best predictors of retention of black studies in engineering are college grades.

College board scores are relatively poor predictors of grades or retention. Freshman expectations of college, Purdue and engineering were similar for black and non-black students but external factors including financial aid were more apt to be important to black students. Black persisters participated in programs designed to assist and support them and had high achievement drives. Black students transferred and withdrew largely due to grades and interest.

Purdue Black B.S. engineering graduates surveyed in 1974 had and were continuing to pursue advanced graduate and professional degrees. They held substantial positions of responsibility in both technical and managerial fields. They were achieving higher than average salaries and generally were quite satisfied with their jobs, careers and choice of engineering and Purdue.

Background

The number and proportion of Black Americans that begin engineering studies have typically been very small. Of those that begin an engineering program, only a few complete them and of those who transfer to other disciplines, the percentage that graduate from college is much smaller than their white counterparts. A 1977 NSF study indicates there were only 8,000 Black Americans employed as engineers in 1974 in the U.S.¹ A Special Planning Commission appointed by the Alfred P. Sloan Foundation made various recommendations and observations in their report Minorities in Engineering --

A Blue Print for Action.² Especially relevant to this study were the following:

The Task Force recommends that U.S. schools of engineering increase the percentages of Black American, Chicano, Puerto Rican, and American Indian students enrolled as freshmen, with the national goal of achieving approximate population parity in the freshman class by 1982, and in all classes by 1987. (page 12)

The Task Force recommends that all schools of engineering provide remedial and tutorial programs, improved orientation and counseling, flexible curricula and, wherever possible, cooperative engineering programs with engineering employers. These should not be looked upon as merely "affirmative action" programs for minorities but should be recognized as essential for large numbers of students, whatever their racial or ethnic background. (page 18)

...The challenge for engineering educators is not just one of attracting more able students to engineering schools, but also one of retaining more of the highly qualified students who do enroll. (page 81)

There are many reasons generally given in an effort to explain why so few blacks begin and graduate from college programs in engineering. Among these are poor high school background in mathematics and science; the attitude prevalent in primarily black high schools that students who do well are looked down upon by their peers; the standardized tests used by many schools as selection criteria, i.e. Scholastic Aptitude Tests and the American College Testing Program, are culturally biased; and the genuine concern that even though a black student receives education and training as exemplified by a college degree or the like, "equal access" is not a reality. Still others particularly applicable to predominantly white colleges are that a black student will not receive fair treatment with regard to grading; the different lifestyle that a black students must adjust to, commonly referred to as "culture shock"; the lack of social life particularly with respect to dating; and when trying to obtain assistance from or studying with non-black

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counterparts the feeling of being shunned or barely tolerated. The last reason to be mentioned, probably the most important and most truthful of all, is the lack of black "role models" that one can look up to and emulate.

In 1974 the National Science Foundation funded a grant to the Purdue Research Foundation to study the factors associated with attracting and retaining Black Americans in Engineering at Purdue. Four monographs on Recruitment and Retention of Black Americans were prepared. The first monograph was concerned with trends and statistical analyses; the second with a study of the expectations of 1974 Purdue engineering freshman regarding college, Purdue and engineering; the third with Black Americans who had begun in engineering between 1966-76 and were persisting in engineering, who had transferred to other fields at Purdue or had withdrawn from Purdue; and the fourth monograph focused on the post-college activities of those black students who attained a B.S. in engineering from Purdue. This report summarizes the highlights from the four monographs.

Trends and Statistical Analyses³

The number and percentage of black students entering engineering at Purdue during 1966 and 1967 were small (14 and 11) and comprised approximately 1% of the overall entering classes of 1463 and 1678, respectively. The black enrollment increased to approximately 2% in 1970 and remained there until 1974. In 1975 the number and percentage of black students beginning engineering at Purdue increased dramatically to 75 or 5.07% of 1480 and 87 or 5.20% of 1674 in 1976. The data show similar but slower growth rates than Purdue's rate. When comparing the combined years 1969-1976, 323 black students entering engineering at Purdue represented 3.17% of the total 10,228; whereas entering freshman on the national level the percentage was 2.68% or 14,758 of 552,000.

In comparing the percentages of degrees conferred to black engineering students there was constant fluctuations in the Purdue percentages ranging from a low of .45% in 1969 to a high of 1.80% in 1976 and nationally from .79% in 1969 to 2.05% in 1976. Summarizing the years 1969-76, the national graduate rate was 1.39% compared to 1.17% for Purdue.

Other statistical trends from 1966-76 included in the statistical phase of the study focused on in-depth longitudinal studies of the changing characteristics of the beginning freshman engineers and retention in engineering and the university.

The most striking feature of data on Purdue black and non-black freshmen students by sex, residency and Counselor-Tutorial (Special Help) participation is the increase in the number and proportion of women students, both black and non-black, entering Purdue. The female freshmen increased steadily from .9% in 1967 to 14.5% in 1975 and dropped slightly to 13.6% in 1976. Among the black students, the female population varied from 0% in 1970 but increased dramatically to 17.9% in

1974, 25% in 1975 and 36.2% in 1976. The Counselor-Tutorial program, which was conceived with the intention of helping those who were educationally disadvantaged, consistently served high percentages of black students (22-55%).

Figure 1 presents trends in College Board means, High School Rank and Grade Point Average for black and non-black engineering freshmen at Purdue. Except for High School Rank, the black students have consistently had lower SAT scores and 1st semester engineering grades. However, Figure 2 shows that there is considerable overlap in the distribution of black and non-black students.

Table 1 provides data on retention in engineering or the university for black and non-black freshmen. The university retention rates of students who began in engineering in 1967 or 1968 were fairly high for black and non-black students. The data for engineering retention indicate that black students were retained in engineering, but at a consistently lower rate than non-black students.

The graduation rates for engineering, shown in Table 2, provides further insight. The black graduation rates in the university and in engineering are consistently lower than the non-black graduation rates.

The impact of the CT program on grades is reflected in Figure 3. The data for the 1971 and 1972 freshmen indicate that after completion of the program (the first two semesters), the grade point index for black and non-black participants declines substantially and recovers gradually.

Expectations of College, Purdue and Engineering⁴

All entering 1974 Black freshman engineers (with a 100% participation rate) and a sample of non-black were surveyed regarding their expectations. Engineering students were surveyed regarding the importance of various reasons to attend college. The value of a degree in preparing for work, hope for an easier life, and interest or curiosity about engineering were the most significant factors for black and non-black freshman. Outside influences were much more prevalent in black student decisions. The influence of teachers was noted by 50% of black students compared to 27% of non-black students, and community leaders influenced 39% of black students but only 9% of non-black students.

Having decided to attend college, when asked the general question "Why Purdue?": the academic quality, type of program, prestige of the institution and variety of programs were evaluated as important by 75-100% of the black and non-black students alike. The only statistical differences were: having received a scholarship, 52% for black and 24% for non-black; other college friends' encouragement, 28% and 8% respectively; and, to a lesser degree, advice of agency personnel, 14% and 2%.

When asked about factors which led to their choice of engineering the ones deemed most important

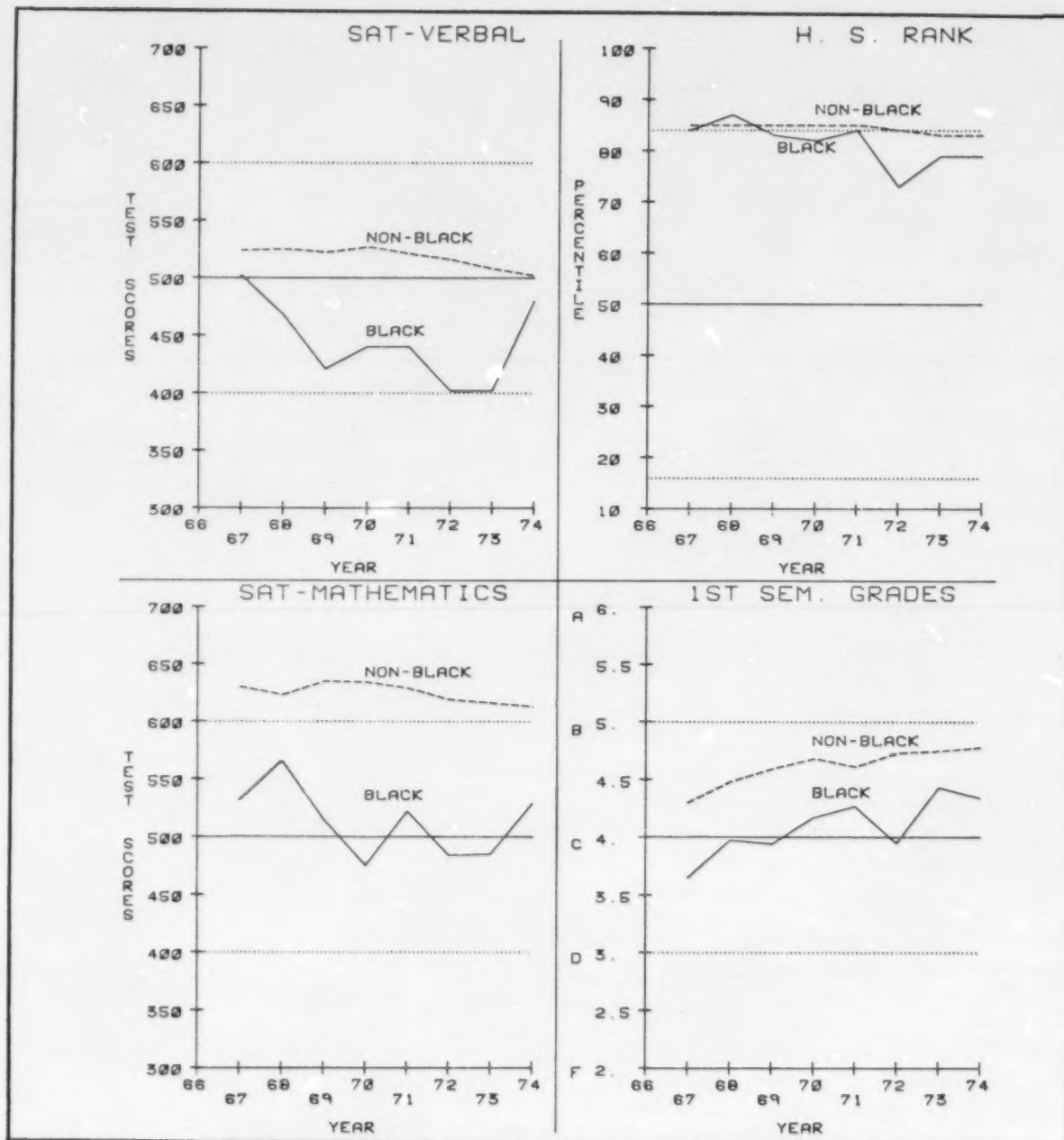


Fig. 1 Trends in Mean Scores of Black and Non-Black Purdue Engineering Freshmen on Pre-College Variables and 1st Semester Grades.

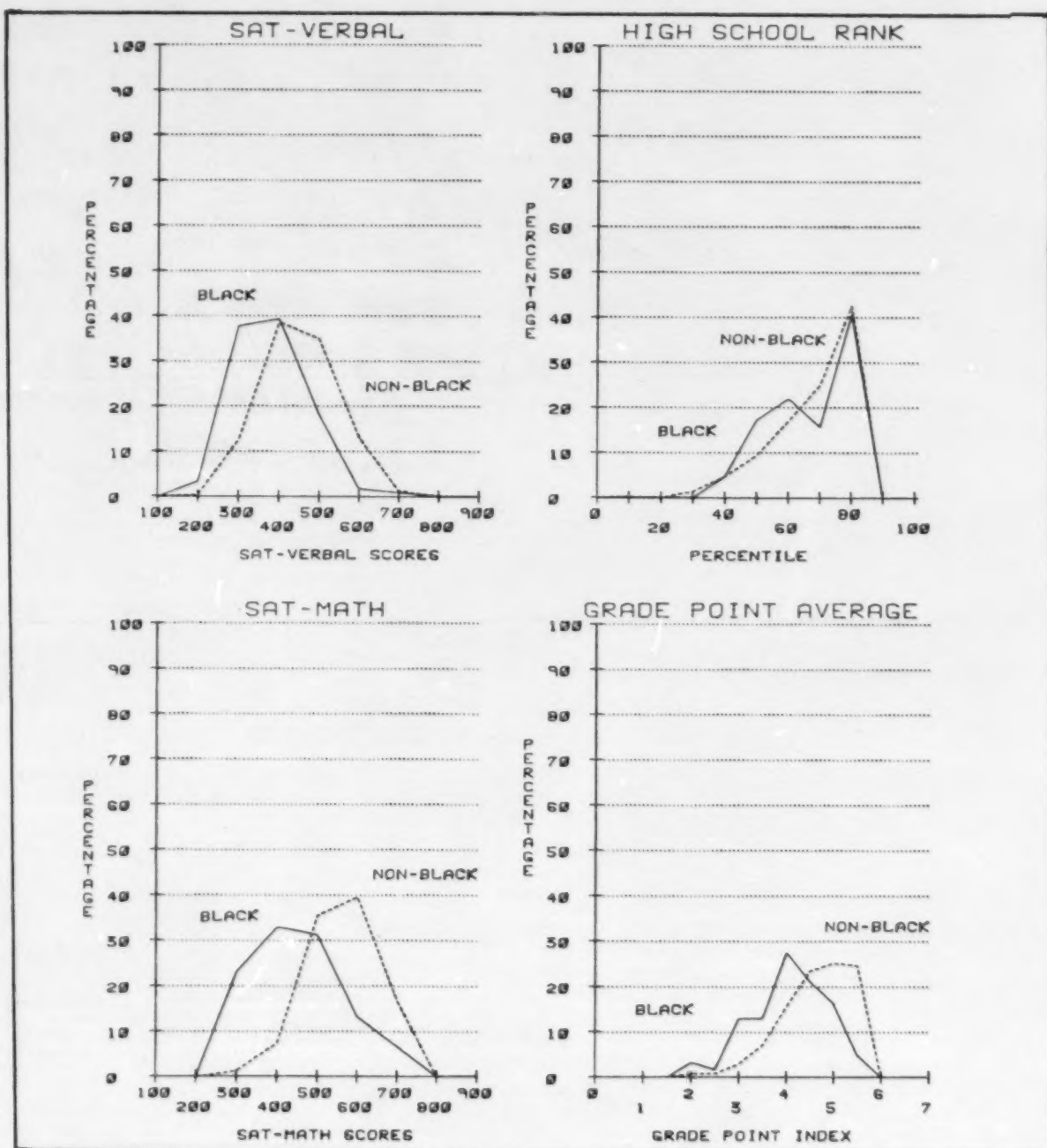


Fig. 2 Percentage Distribution of 1975 Black and Total Purdue Engineering Freshmen on Pre-College Variables and 1st Semester Grades.

TABLE 1

1967-75 TRENDS IN UNIVERSITY AND ENGINEERING RETENTION RATES OF TOTAL BLACK AND NON-BLACK BEGINNING ENGINEERING FRESHMEN BY SEMESTER (IN PERCENTAGES)

YEAR	GROUP	UNIVERSITY RETENTION RATES										ENGINEERING RETENTION RATES										
		SEMESTER										SEMESTER										
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	
1967	TOTAL	100	97	87	82	77	74	73	72	70	70	100	87	68	54	44	42	40	39	38	36	
1967	NON-BLACK	100	97	87	83	78	74	73	72	70	70	100	87	68	54	44	42	40	39	38	36	
1967	BLACK	100	94	76	59	59	59	53	59	65	65	100	82	71	41	35	29	24	29	29	29	
1968	TOTAL	100	98	87	81	77	75	74	73	72	71	100	91	70	59	51	48	46	45	45	44	
1968	NON-BLACK	100	98	87	81	77	75	74	73	72	71	100	91	70	59	51	48	46	45	45	44	
1968	BLACK	100	100	92	84	68	64	76	80	76	76	100	88	72	60	44	44	44	36	27	32	
1969	TOTAL	100	97		83		74		76							91		65		53		52
1969	NON-BLACK	100	97		83		74		76							91		65		53		52
1969	BLACK	100	94		53		47		59							88		35		24		36
1970	TOTAL	100	96	84	80	76	74	73	72	69	69	99	90	70	59	53	51	50	48	47	47	
1970	NON-BLACK	100	96	84	81	76	75	73	72	70	70	100	90	70	60	53	51	50	49	48	47	
1970	BLACK	100	100	77	71	68	65	55	55	55	48	97	90	65	52	39	39	32	26	26	19	
1971	TOTAL	99	95	85	82	77	76	74	74	72		97	87	72	64	59	57	56	55	54		
1971	NON-BLACK	99	95	85	82	78	76	74	74	72		98	87	71	64	59	57	56	55	54		
1971	BLACK	92	96	88	84	64	60	60	68	48		80	88	80	76	46	52	52	56	40		
1972	TOTAL	100	97	88	84	81	80	79				98	90	76	68	64	63	61				
1972	NON-BLACK	100	97	88	84	82	81	79				99	91	77	69	64	64	61				
1972	BLACK	100	93	82	57	54	57	54				82	64	57	43	36	36	32				
1973	TOTAL	100	97	89	85	81						97	89	79	69	65						
1973	NON-BLACK	100	97	89	85	82						98	90	79	70	66						
1973	BLACK	100	100	91	74	68						88	79	71	47	50						
1974	TOTAL	99	96	89	84							97	88	77	70							
1974	NON-BLACK	99	96	89	84							97	87	77	70							
1974	BLACK	100	100	86	79							100	96	79	75							
1975	TOTAL	100	96									99	90									
1975	NON-BLACK	100	97									98	90									
1975	BLACK	100	90									100	87									

TABLE 2

TRENDS IN ENGINEERING AND UNIVERSITY GRADUATION RATES FOR PURDUE UNIVERSITY TOTAL, NON-BLACK AND BLACK ENGINEERING STUDENTS BY NUMBER OF SEMESTERS (IN PERCENTAGES)

YEAR	GROUP	NO OF CASES	ENGINEERING GRADUATION RATES															UNIVERSITY GRADUATION RATES														
			SEMESTER															SEMESTER														
			6	7	8	9	10	11	12	13	14	15	6	7	8	9	10	11	12	13	14	15										
1967	TOTAL	1643	00	01	21	28	34	36	36	36	37	37	03	04	39	53	62	66	67	68	69	69										
	NON-BLACK	1626	00	01	21	28	34	36	36	36	37	37	03	06	40	53	62	66	67	68	69	69										
	BLACK	17	00	00	12	12	24	24	24	24	24	24	00	00	18	24	47	47	59	59	59	59										
1968	TOTAL	1470	00	01	25	32	39	40	40	41			03	06	42	53	63	65	66	67												
	NON-BLACK	1445	00	01	26	32	39	40	40	41			03	06	42	53	63	65	66	68												
	BLACK	25	00	00	08	08	16	24	24	24			00	04	40	44	52	60	60	60												
1969	TOTAL	1325																														
	NON-BLACK	1318																														
	BLACK	17																														
1970	TOTAL	1446	00	03	27	34	41	42					04	08	39	51	61	63														
	NON-BLACK	1415	00	03	27	35	41	42					04	08	40	52	61	63														
	BLACK	31	00	00	03	16	16	19					03	03	06	23	29	32														
1971	TOTAL	1086	00	03	30	38							03	07	42	52																
	NON-BLACK	1061	00	03	30	38							03	07	42	52																
	BLACK	25	00	00	16	28							00	00	24	36																

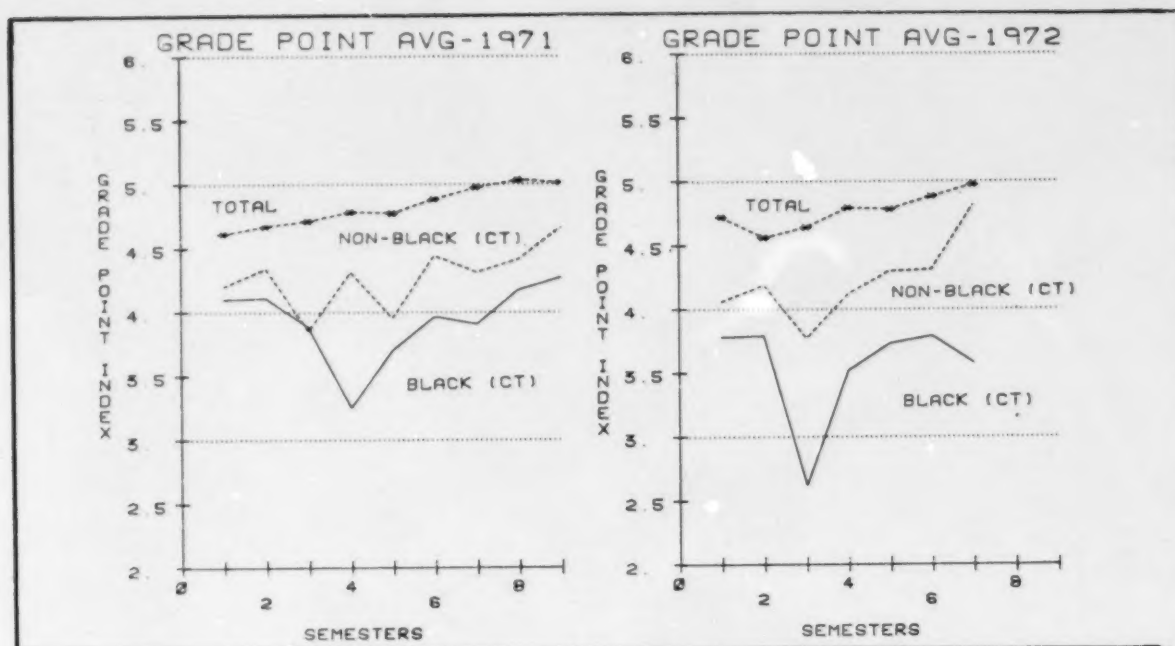


Fig. 3 Grade Point Index by Semester of Black and Non-Black Participants and Total Purdue Engineering Students Who Began as Freshmen in September 1971 and 1972.

by 75-91% were the type of work, salary, interest, security and mathematics courses. A few factors were more important to black students than non-black students: (1) being of service to others (86% to 60%); (2) vocational-educational information (55% to 27%); (3) engineering students they know (43% to 21%); and (4) mass media (37% to 20%). However, the influence of the father was an overwhelming factor for non-black students with 61% noting this as a prime influence compared to only 36% for black students.

Persisters, Withdrawals and Transfers⁵

Black Americans who began in engineering at Purdue and persisted, transferred or withdrew were asked to respond to a 1974 follow-up survey. This group consisted of students who were enrolled during the years 1967 to 1973. The prevailing reasons given for attending Purdue were its academic quality and the type of academic programs available. The more important reasons for studying engineering were related to salary, job opportunities and an interest in problem solving. Most black students who were admitted to Purdue but later cancelled, attended college elsewhere, usually in engineering. The main reasons for cancelling were financially related.

Engineering persisters were more apt to be achievement oriented and more often participated in professional activities and programs designed to assist black students. The transfers changed their career decisions most frequently due to lower grades and interests. The withdrawals were more apt to have left Purdue due to academic difficulties, low spirits, loneliness and pressure and strain; yet the majority of withdrawals said they would do it again if they had it to do over, and most planned to return to Purdue in engineering.

Analysis of variance was also used to compare within black and non-black engineering persisters, transfers and withdrawals. College grades were much more significantly and positively related to persistence in engineering for both black and non-black students than pre-college variables including scholastic aptitude tests. Admissions policies primarily based on relative high school performance and supportive programs appear to be the keys to assuring Black Americans equal access to engineering careers.

A Follow-up Study of Black Engineering Graduates⁶

Ninety-eight Black American B.S. degree

graduates who studied engineering between 1938-74 at Purdue University were sent mail questionnaires in 1974 and 64% returned them. Over 90% of the black engineering alumni planned additional education at the M.S. degree or higher and over 40% had been awarded the Master's degree or higher. Most of the graduates held high level technical and supervisory jobs in engineering and allied fields; 90% were very satisfied or satisfied with their jobs; their median annual salary was \$18,000 and ranged from \$7,000 to over \$50,000. Salaries were above the national average for engineers with comparable experience. Over 80% of the black graduates were satisfied with their choice of engineering careers and Purdue Engineering, laboratory and mathematics courses including both practical and theoretical courses were given especially high ratings. The black engineering alumni especially the 1938-66 graduates were more often dissatisfied with some aspects of campus life including dating, counseling services, social life, tutorial services and opportunities to pursue black studies; however, recent graduates (1967-74) seem to be more satisfied with these aspects. Over 90% indicated liking the type of work and interest in problem solving as important considerations in their decision to study engineering. Over 90% indicated the academic quality, prestige and type of academic program in engineering as the primary reasons for their decision to attend Purdue.

Summary

The overall results of the study indicate that the number and proportion of black students beginning engineering at Purdue and nationally has increased significantly in recent years, but the number of graduates is still relatively small. The best predictors of retention of black students in engineering are college grades.

College board scores are relatively poor predictors of grades or retention. Freshman expectations of college, Purdue and engineering were similar for black and non-black students but external factors including financial aid were more apt to be important to black students. Black persisters participated in programs designed to assist and support them and had high achievement drives. Black students transferred and withdrew largely due to grades and interest.

Purdue black B.S. engineering graduates surveyed in 1974 had and were continuing to pursue advanced graduate and professional degrees. They held substantial positions of responsibility in both technical and managerial fields. They were achieving higher than average salaries and generally were quite satisfied with their jobs, careers and choice of engineering and Purdue.

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